

## **Science Mission**

**SAFETY and MISSION ASSURANCE**

# **PRELAUNCH INTEGRATED MISSION ASSURANCE REVIEW (IMAR)**

## **PROCESS OPERATING PLAN** (OSMA-IMAR-POP-03-03 Rev 0)

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Submitted by:                     /s/                     Date: 3/24/03  
Patrick A. Martin  
OSMA Science Mission Lead  
Office of Safety and Mission Assurance

Approved by:                     /s/                     Date: 3/24/03  
Bryan D. O'Connor  
Associate Administrator  
Office of Safety and Mission Assurance

## Record of Changes

Change No.	Date	Title or Brief Description	Entered By	Date Entered

## **1.0 INTRODUCTION**

Throughout this document the Safety, Reliability, and Quality Assurance (SR&QA) and Safety and Mission Assurance (S&MA) organizations are referred to as “SMA”.

The Science Mission “Integrated Mission Assurance Review” is held to assess and confirm satisfactory completion of all of the SMA activities necessary to provide an acceptable level of confidence in mission success. The pre-launch “Integrated Mission Assurance Review” (IMAR) provides the mechanism for all of the responsible Science Mission SMA elements to assess mission preparation status, open work, issues and concerns, and provide a consolidated assessment of system readiness.

The pre-launch IMAR is intended to result in the participants demonstrating a complete understanding of the individual element and integrated mission risks and to provide the basis for the AA, OSMA (or designee), to knowledgeably sign the Certification of Flight Readiness (COFR). The IMAR participants should include the SMA Director (or designee) from each center providing an element of the science mission, such as the launch service, spacecraft, instruments, and operations.

NOTE: Prior to the pre-launch IMAR, SMA provides ongoing assessments of the entire science mission life-cycle via a series of activities and reviews. (As outlined in NPG 8709.2 “NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicle Services”).

## **2.0 PURPOSE**

The purpose of this plan is to define and provide consistency in the assessment and reporting activities of the SMA organizations in support of the Science Mission pre-launch IMAR, which is an element of each Science Mission readiness review process.

### **2.1. Pre-launch Integrated Mission Assurance Review (IMAR) Schedule**

Pre-launch IMAR meetings are scheduled to occur following the KSC Center Director’s Launch Vehicle Readiness Review and the Spacecraft Mission Readiness Reviews. (The IMAR should be held approximately 2–4 weeks prior to launch.)

## **3.0 SCOPE and APPLICABILITY**

This plan applies to the NASA SMA organizations and their contractors who have responsibilities in the design, development, processing, integration, and operation of Science Mission flight and ground hardware and software. (For the purposes of this plan, science mission is defined as the spacecraft and instruments, the

mission operations, and the launch service.) In order to meet the requirements contained in this document, lower level requirements and operating plans may be developed as required by the spacecraft/instrument organizations, the launch vehicle organization, and the mission operations organizations.

## **4.0 RESPONSIBILITIES**

This section defines the SMA responsibilities for the pre-launch IMAR. It defines the assessment activities of the project elements to obtain consistency in reporting among various organizations.

### **4.1 Associate Administrator for Safety and Mission Assurance**

- a. Chair the pre-launch IMAR meeting teleconference.
- b. Provide the SMA signature on the mission "Certification of Flight Readiness" statement (CoFR) certifying that for each of the mission elements, all the necessary and appropriate SMA activities have been successfully completed and all of the identified mission SMA risks have been assessed and controlled to an acceptable level. NOTE: The Associate Administrator for Safety and Mission Assurance may delegate this authority.

### **4.2 KSC Safety, Health, and Independent Assessment (SHIA)**

KSC SHIA is responsible for coordinating the activities related to the reporting of data elements assessed by the Science Mission SMA organizations.

In support of the pre-launch IMAR, KSC SHIA or their designee will:

- a. Schedule pre-launch IMARs.
- b. Transmit the meeting agenda to each participating organization.
- c. Provide for recording of each pre-launch IMAR session.
- d. Record and track IMAR action items.
- e. Generate an IMAR presentation package using data reported by the mission elements (KSC for the launch service, the NASA Center(s) responsible for the spacecraft/instruments, and the NASA Center responsible for mission operations).
- f. Present the results of any applicable Independent Assessments (IA's).

- g. Generate the SMA Certification of Flight Readiness (*or mission readiness statement*) that will be signed by the SMA Directors assigned to each mission element at the conclusion of the pre-launch IMAR.

#### **4.3. Science Mission Element SMA Organization**

Each Science Mission element SMA organization will:

- a. Conduct the element SMA assessment.
- b. Prepare necessary charts and backup material for pre-launch IMAR meeting in accordance with Table 1. These data elements apply to flight hardware and support equipment, as well as NASA and non-NASA developed spacecraft and instruments and mission operations planning.
- c. Provide summaries of the applicable special and/or independent SMA assessments that have been conducted. (Independent Review Teams, etc).
- d. Respond to assigned action items.
- e. Each Science Mission element SMA Director (or designee) will make a decision to sign an SMA Certification of Flight Readiness (mission readiness statement) for their respective mission element and the (consolidated) Integrated Science Mission at the conclusion of the pre-launch IMAR.

#### **5.0 DATA REPORTING**

Each Science Mission element SMA organization will report in accordance with the following tables.

### 5.1 Table 1. “Integrated Mission Assurance Review” Data Reporting Guideline

Data Element	Launch Service	Spacecraft	Instruments	Operations
Mission Overview	X	X	X	X
Mission Success Criteria	X	X	X	
Configuration	X*	X	X	X
SMA Lifecycle Activities Overview	X	X	X	X
Test and Qualification Overview	X*	X	X	X
Hazard Analysis	X	X	X	X
Mission Rules	X*	X	X	X
Fault Tree Analysis / FMEA/CIL / PRA	X*	X	X	X
Contingency Planning	X	X	X	X
Independent Analysis	X	X	X	
Alerts	X	X	X	
Software	X*	X	X	X
Hardware Problems/ PR's	X	X	X	
Range Safety Issues	X	X		
Limited-Life Items	X	X	X	
Training	X			X
Launch Service Qualification Status	X			
NASA Safety Reporting System	X	X	X	X
Lessons Learned Review	X	X	X	X
Orbital Debris and Disposal Analysis	X	X		X
Accepted / Residual Risk	X	X	X	X

\* Elements for Mission Unique and First (NASA) Flight Items

## 5.2 Table 2. IMAR Data Element Definitions

### **Mission Overview**

- Provide a summary of the overall mission and for each element of the mission.
- Identify the payload risk category in accordance with NPD 8610.7.

### **Mission Success Criteria**

- Identify the mission objectives, science objectives, mission success criteria (minimum and full), for each element.
- Summarize the PCA and identify any open issues.

### **Configuration**

- Identify the configuration of each element including the launch vehicle, the spacecraft and instruments, and the operations scenario.

### **SMA Lifecycle Activities Overview**

- Provide an overview of the SMA activities that were performed in support of each mission element. *(Use the Roles and Responsibilities outlined in NPG 8709.2 and provide background and supporting rationale for any deviations.)*

### **Test and Qualification Overview**

- Provide an overview of the test and validation process applied to each element, including any deviations from the “test like you fly” approach and the supporting rationale. Identify any open issues with background and actions being taken.

### **Hazard Analysis**

- Provide the status of any open hazards and the estimated date of closure.
- Provide background and actions taken on any unusual or unique hazards.
- Provide background on any safety waivers, deviations, or noncompliances.

### **Mission Rules**

- Identify any mission rules considered to be a constraint and provide background and action being taken.



## 5.2 Table 2. IMAR Data Element Definitions

<b><u>Fault Tree Analysis / FMEA/CIL / PRA</u></b> <ul style="list-style-type: none"> <li>Provide a summary of the Fault Tree analysis, FMEA/CIL analysis, and PRA performed. Identify the top level undesired events analyzed, the significant basic events identified, the corrective actions taken, and any open FTA, FMEA/CIL or PRA issues.</li> </ul>
<b><u>Contingency Planning</u></b> <ul style="list-style-type: none"> <li>Provide a summary of the launch and early operations contingency planning and identify any open issues with background and actions being taken.</li> </ul>
<b><u>Independent Analysis</u></b> <ul style="list-style-type: none"> <li>Provide a summary of the independent analysis activities and identify any open issues with background and actions being taken.</li> </ul>
<b><u>Alerts</u></b> <ul style="list-style-type: none"> <li>Identify any open alerts considered to be a potential constraint and provide background and actions being taken.</li> </ul>
<b><u>Software</u></b> <ul style="list-style-type: none"> <li>Identify the software quality assurance processes and testing employed (i.e., V&amp;V and IV&amp;V)</li> <li>Identify any software or software quality assurance issues and concerns.</li> </ul>
<b><u>Hardware Problems/ PR's</u></b> <ul style="list-style-type: none"> <li>Identify any open hardware issues or unexplained anomalies, with background and actions being taken. <ul style="list-style-type: none"> <li>Identify any open in-flight anomalies from previous missions that may be considered to be a constraint, with background and actions being taken.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>Range Safety Identify any Range Safety issues, including any open waivers/deviations that may be considered to be a constraint with background and actions being taken.</li> <li>Provide background and actions taken on any unusual or unique Range Safety considerations.</li> <li>Provide results of the Expected Casualty Analysis for the mission launch.</li> </ul>

## 5.2 Table 2. IMAR Data Element Definitions

<p><b><u>Limited Life Items</u></b></p> <ul style="list-style-type: none"> <li>• Identify any limited life hardware that may be considered to be a constraint with background and actions being taken.</li> <li>• Provide an assessment of limited-life items to support the planned launch date +30 days, and +60 days.</li> </ul>
<p><b><u>Training</u></b></p> <ul style="list-style-type: none"> <li>• Provide a summary of the launch service and mission operations training requirements and identify any open issues, with background and actions being taken.</li> </ul>
<p><b><u>Launch Service Qualification Status</u></b></p> <ul style="list-style-type: none"> <li>• Identify risk associated with Launch Vehicle Qualification Process in accordance with NPD 8610.7.</li> <li>• Provide a summary of the launch service design reliability and current demonstrated reliability.</li> </ul>
<p><b><u>NASA Safety Reporting System</u></b></p> <ul style="list-style-type: none"> <li>• Provide status of applicable open NSRS reports and identify any considered to be a potential constraint and provide background and action taken.</li> </ul>
<p><b><u>Lessons Learned Review</u></b></p> <ul style="list-style-type: none"> <li>• Identify any applicable items from the LLIS that remain to be addressed, with background and actions being taken.</li> </ul>
<p><b><u>Orbital Debris and Disposal Analysis summary</u></b></p> <ul style="list-style-type: none"> <li>• Provide a summary of the orbital debris assessment and disposal plans with risk summary.</li> </ul>
<p><b><u>Accepted / Residual Risk Summary</u></b></p> <ul style="list-style-type: none"> <li>• Provide a summary of all mission risks for each element and for the integrated mission and provide a (qualitative) assessment of the integrated mission risk (i.e., single-string design, test program deficiencies, unexplained anomalies, etc.).</li> </ul>